

A 0.05 degree global climate/interdisciplinary long term data set from AVHRR, MODIS and VIIRS

PI & Co-I's:

- *NASA GSFC*: Ed Masuoka (PI), Nazmi Saleous, Jeff Privette, Jim Tucker & Jorge Pinzon.
- *UMD*: Eric Vermote, David Roy & Steve Prince.

Collaborator: Chris Justice (UMD).

NASA Study Manager: Dr. Diane Wickland.

Long Term Land Data Record

- Develop and produce a global long term coarse spatial resolution (0.05deg) data record from AVHRR, MODIS and VIIRS for use in global change and climate studies.
 - The data record will help answer questions related to variation of some elements such as length of growing season and aerosol emission in the last three decades (1981-2007).
- Use a MODIS-like operational production approach including an operational QA team.
- Set up an advisory panel.
- Hold community workshops for outreach and feedback.

Proposed LTLD Products

AVHRR, MODIS, VIIRS:

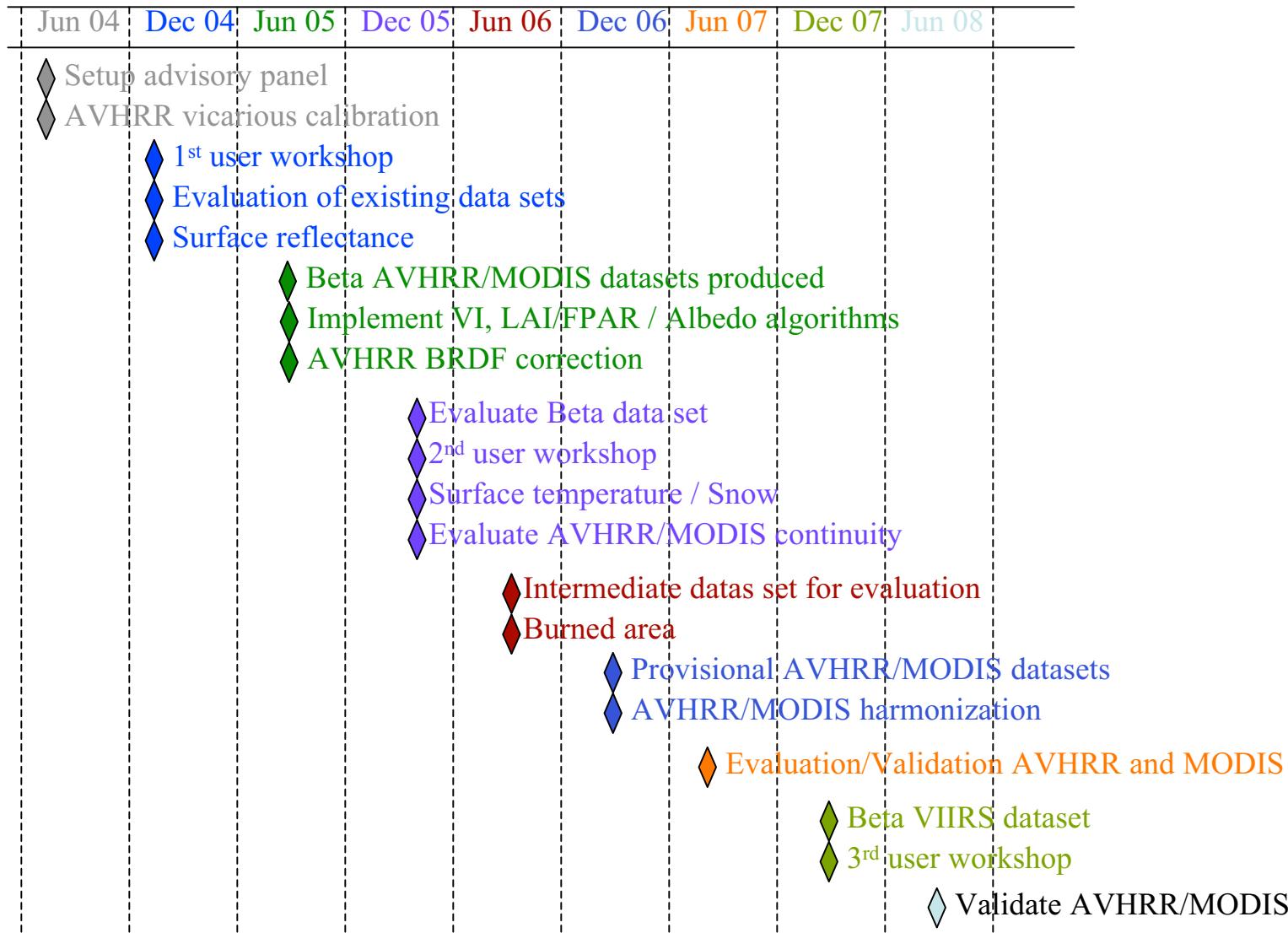
- Surface reflectance
- Surface temperature and emissivity
- Vegetation Indices
- Snow
- LAI/FPAR
- BRDF/Albedo
- Aerosols
- Burned area

Products and formats will be modified based on feedback from the User Community Workshops.

Progress to Date

- UMD contracts funded
- Computer systems ordered
- Agreed on topics for first workshop at AGU in December
- First cut at advisory panel
- In-flight (vicarious calibration) approach - done
- Validate NOAA16 calibration approach- started

Project timeline



Generating Improved AVHRR products

Goal to make the AVHRR data set temporally consistent and spectrally consistent with MODIS by using:

- Reliable and consistent calibration across the different NOAA platforms.
- BRDF correction to address differences in the solar and viewing geometry.
- Apply MODIS algorithms to AVHRR where possible, e.g.: the MODIS aerosol retrieval and atmospheric correction approach.
- Coincident AVHRR/MODIS to evaluate and improve AVHRR products and quantify accuracy.

Recent Activities

- Improve AVHRR L1B – coordinate with NOAA.
- AVHRR in-flight calibration
- Approach to improve AVHRR atmospheric correction: water vapor retrieval.
- Adapt Pathfinder II code.
- Evaluate existing AVHRR data sets: Pathfinder I and GIMMS.
- Develop a QA approach inspired from MODIS Land QA activities: Global browse, Time series analysis.

Improve AVHRR L1B

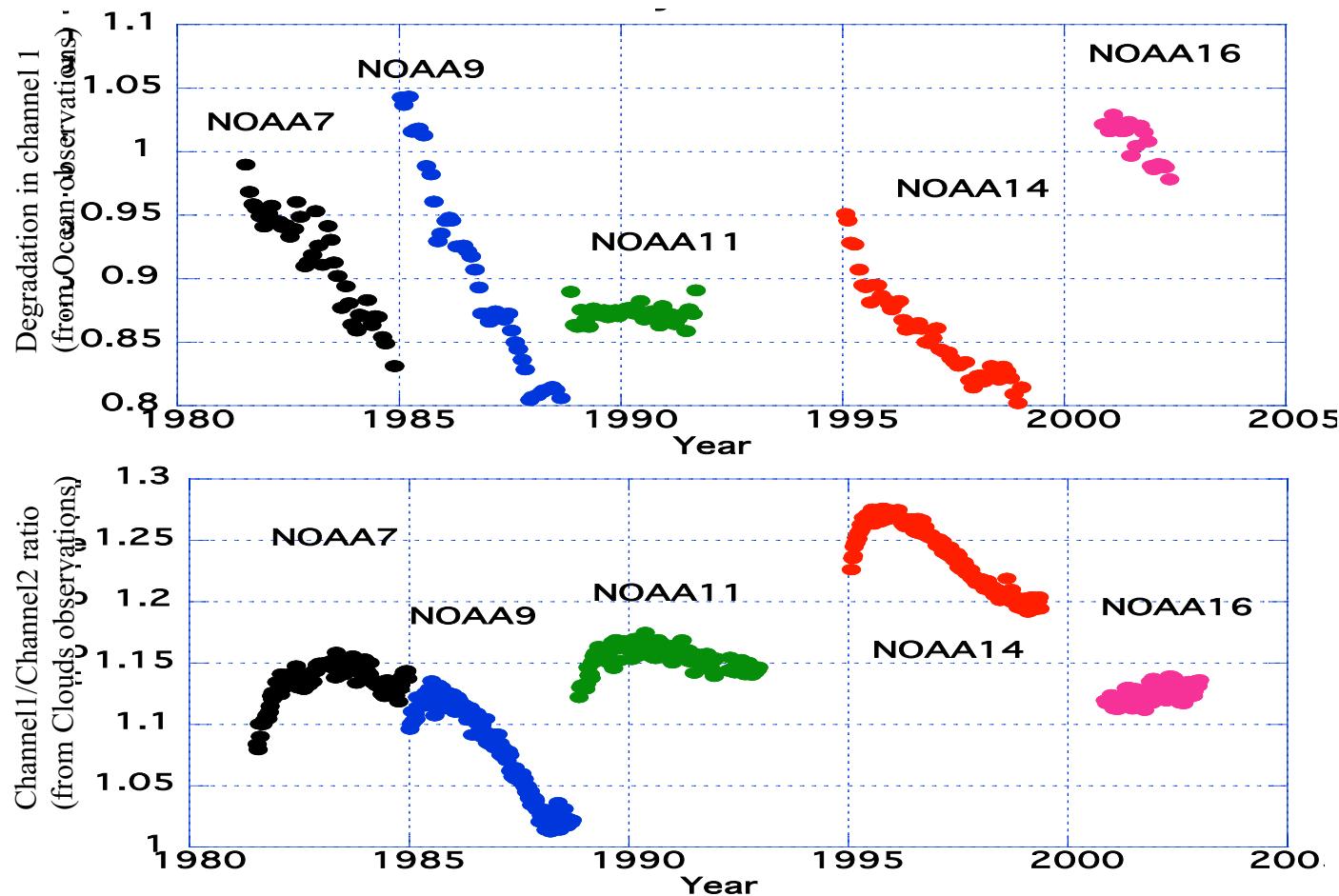
- Use a MODIS-like HDF-EOS format.
- Save in 5-min orbital segments (granules).
- Add accurate geolocation information.

AVHRR in-flight calibration approach

- Use clear ocean to determine the absolute calibration in the red band (Rayleigh).
- Use high reflective clouds to determine the red/NIR ratio.
- Validate using desert sites.

Consistent AVHRR calibration across platforms

- Use the Vermote/Kaufman calibration approach (Pathfinder II)



Use MODIS to validate N16 calibration / Approach

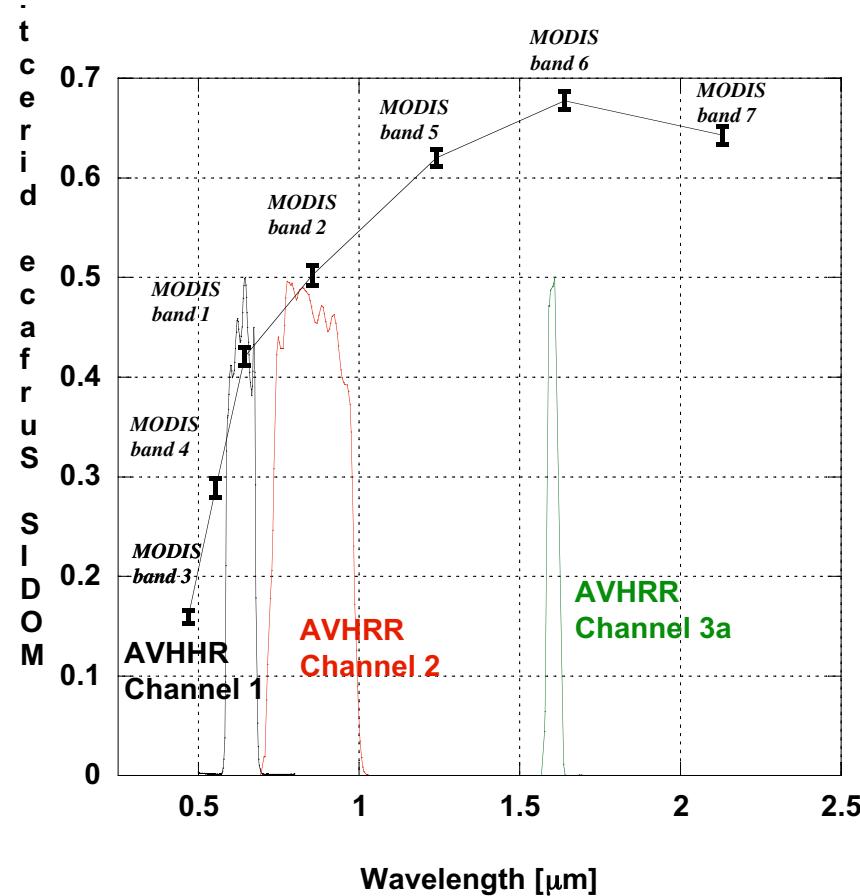
- Select a stable site.
- Rigorous cloud screening is applied to the data (using standard deviation as well).
- Characterize the reflectance spectral variation using MODIS narrow bands
- Use 2 years of data to characterize BRDF using a simple linear kernel model (3 parameters) used operational in MODIS-land
- Check the temporal stability
- Once the site is characterized, the reflectance could be predicted for any sensor using the BRDF model and spectral adjustments.

Site location

20km x 20km



Site spectral characterization



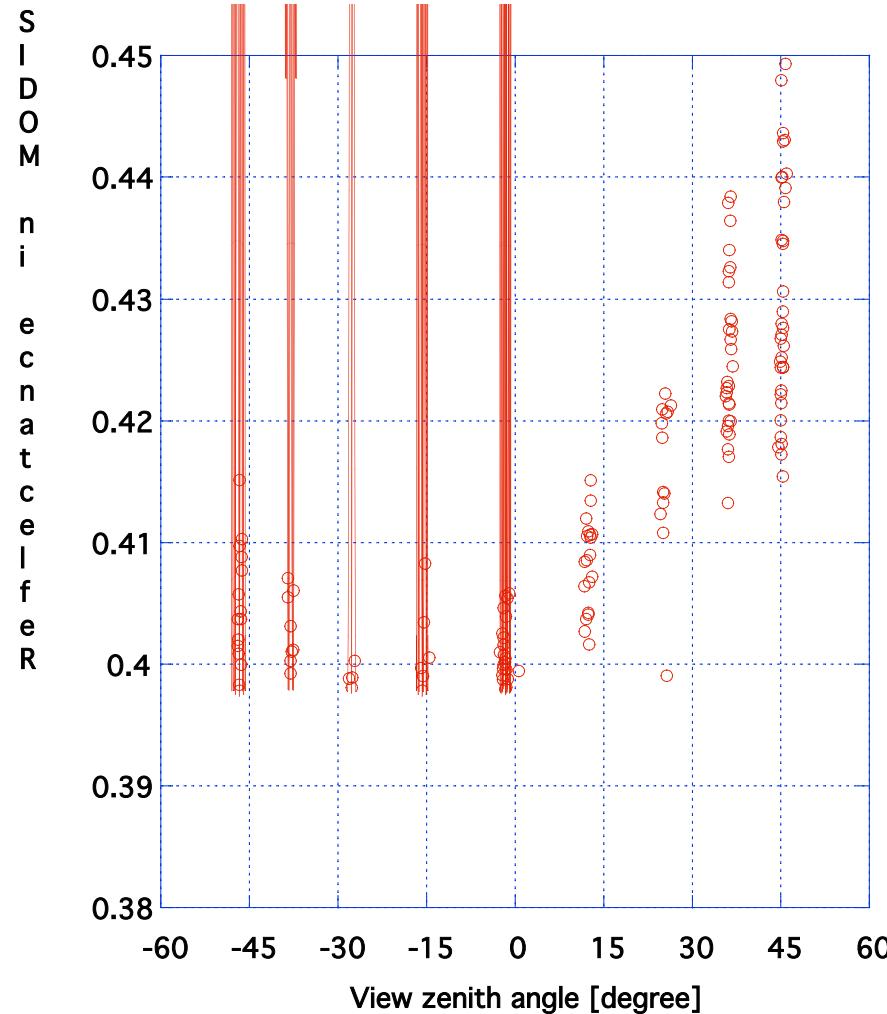
Spectral adjustment

AVHRR channel 1 = 0.952 x MODIS band 1

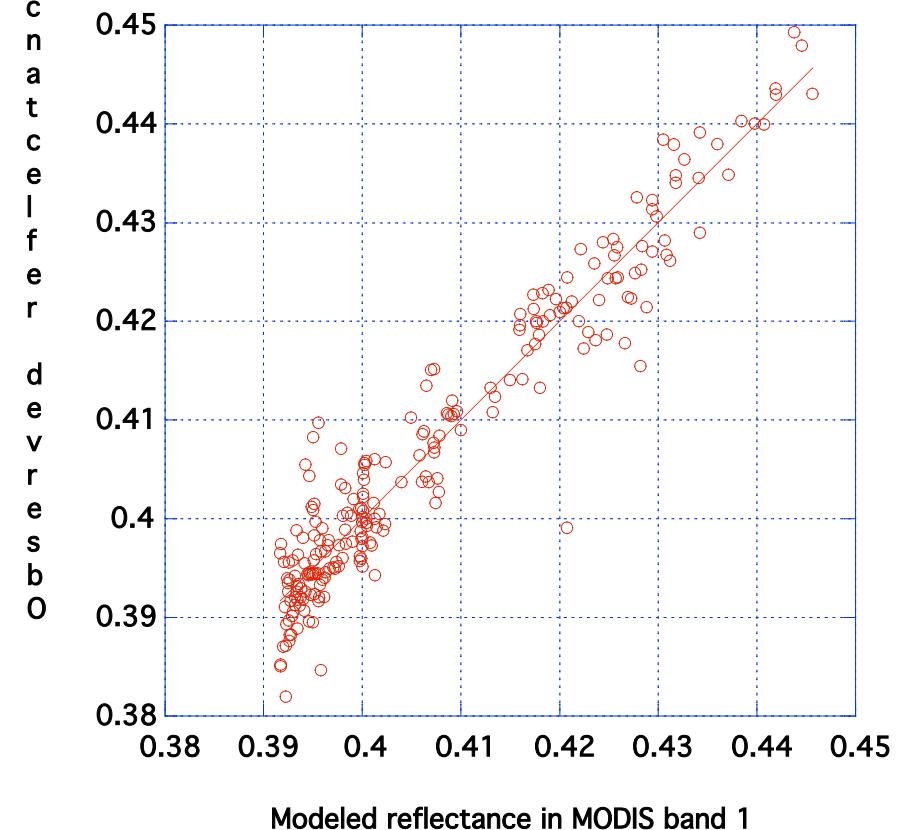
AVHRR channel 2 = 0.988 x MODIS band 2

AVHRR channel 3 = 0.994 x MODIS band 6

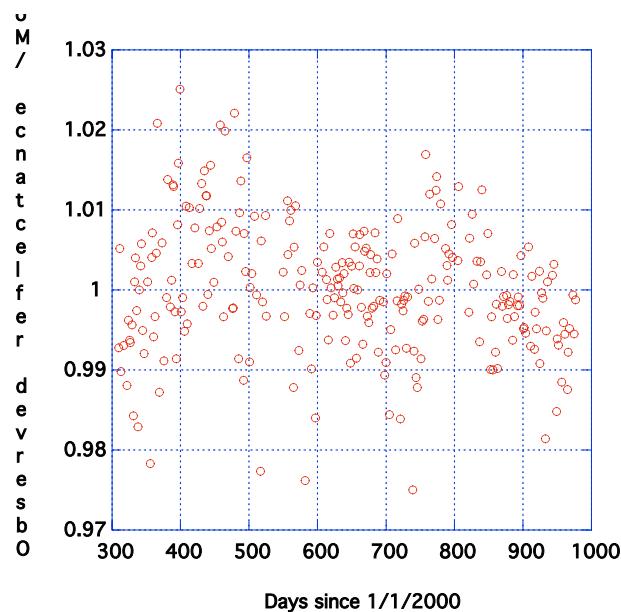
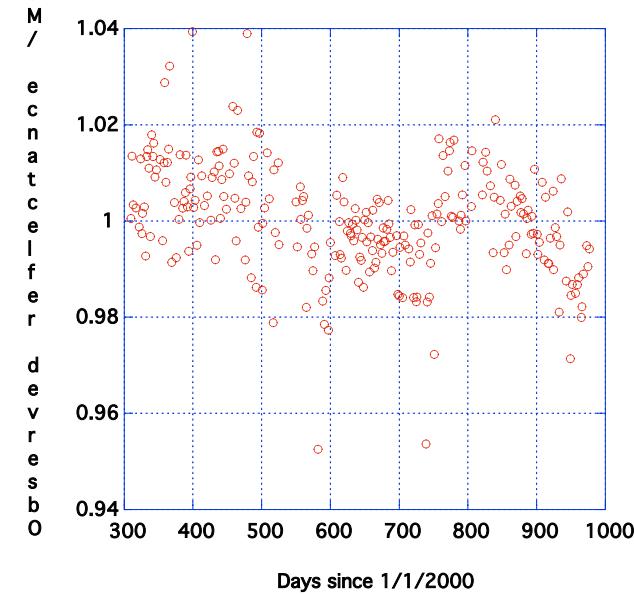
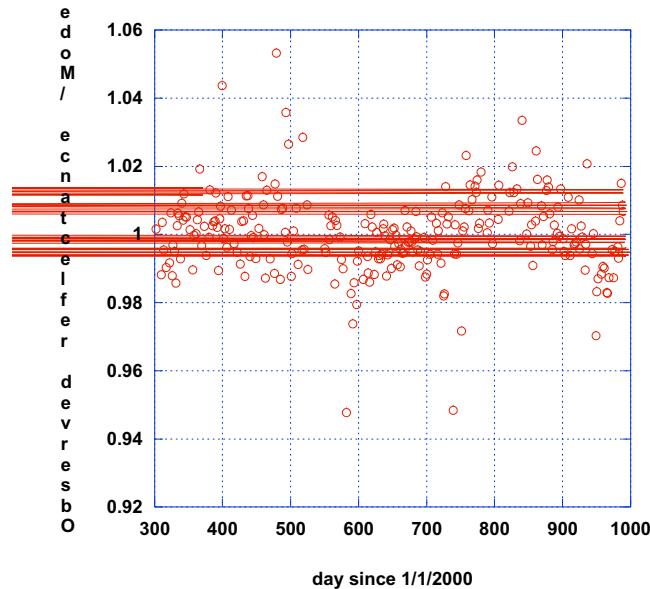
Site BRDF characterization



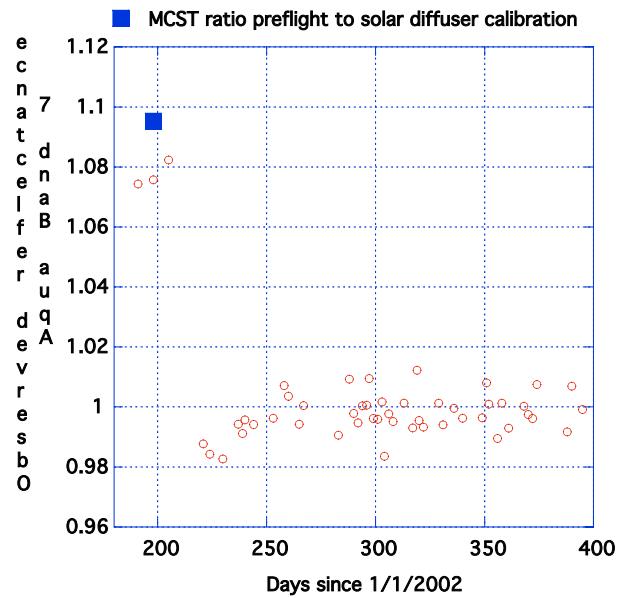
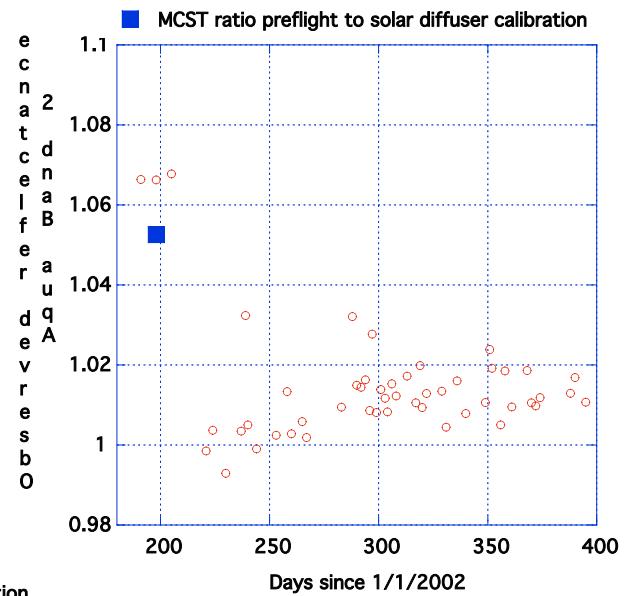
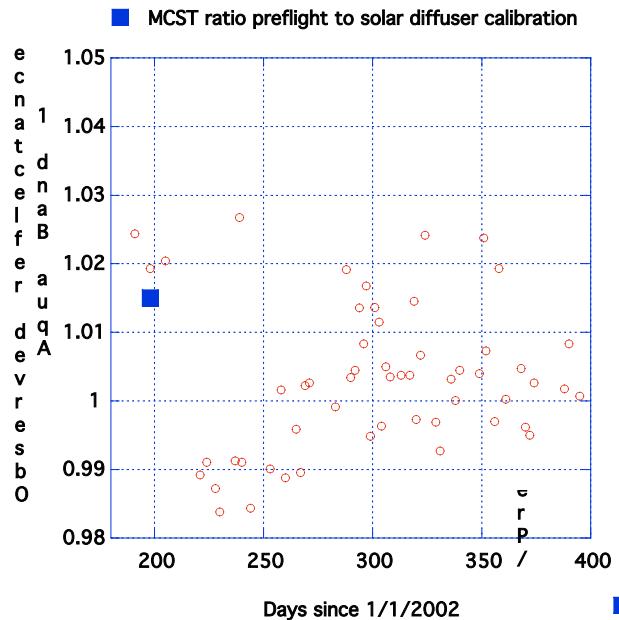
The BRDF was derived using the MODIS BRDF model (RossThick, LiSparse reciprocal linear kernel)



Site temporal stability

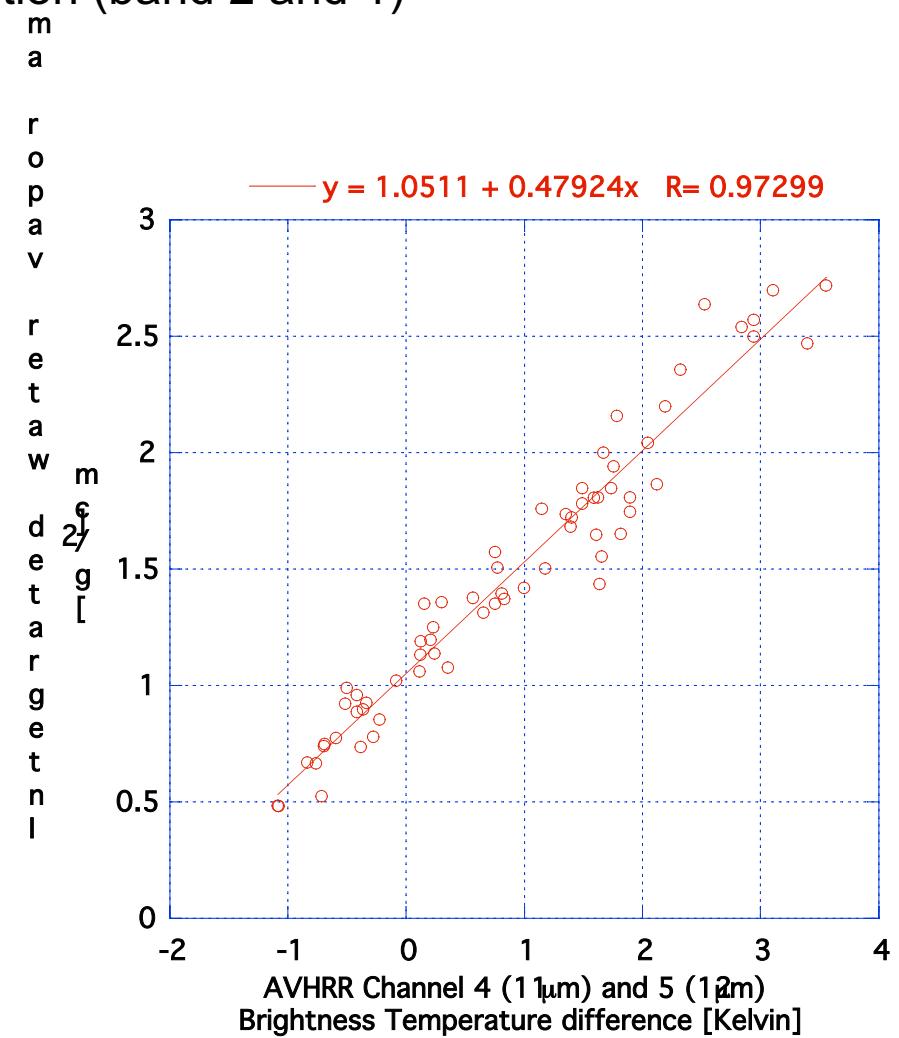
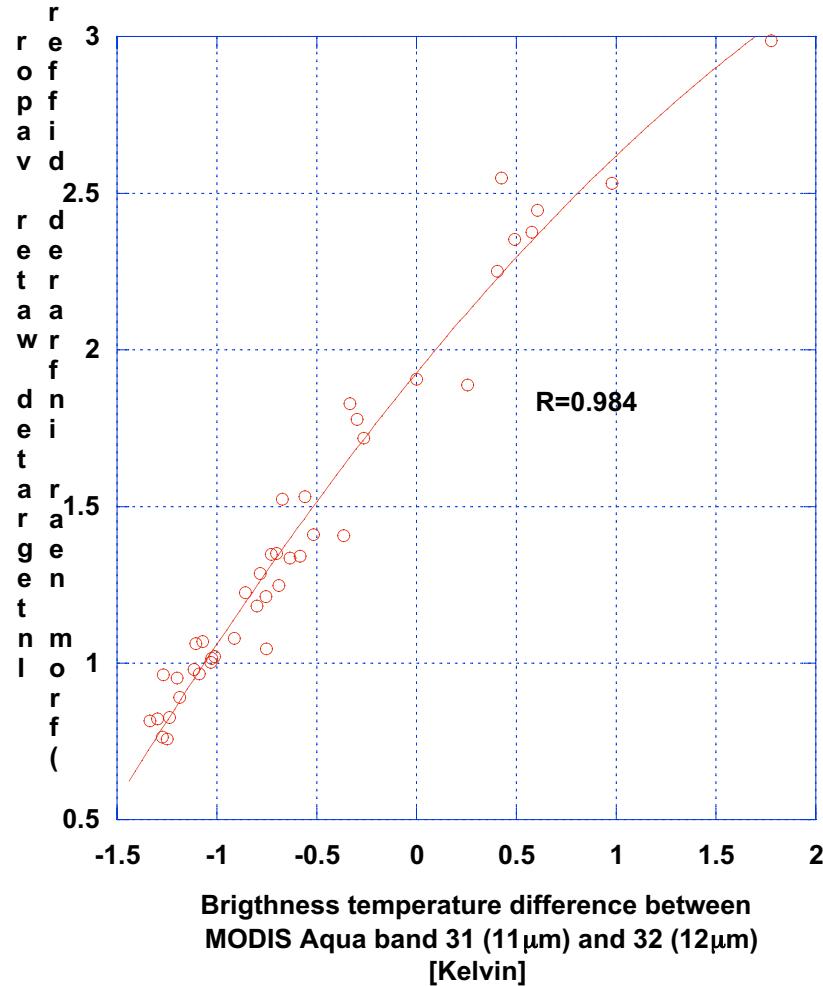


Cross Calibration MODIS Terra-> Aqua

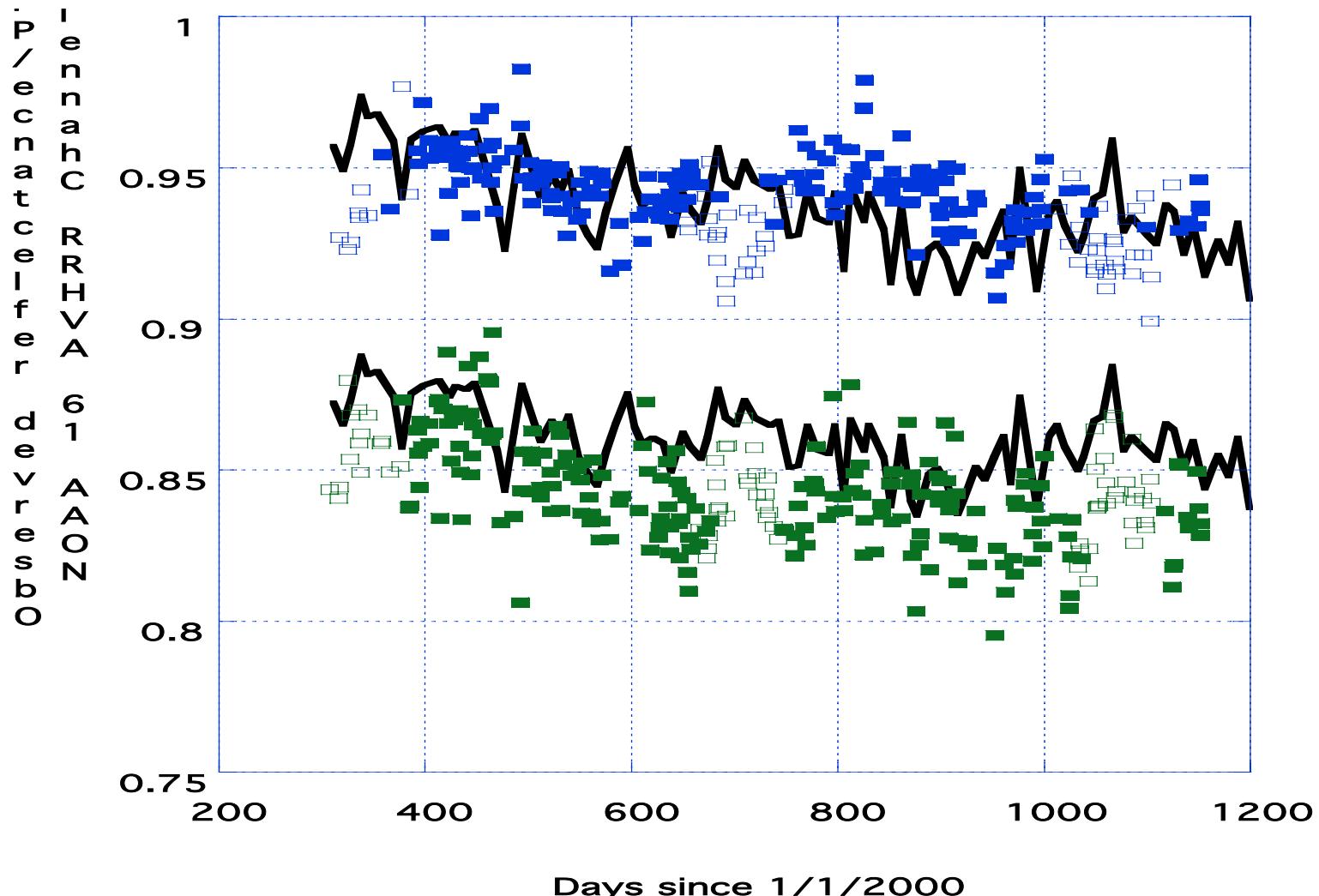


Water vapor retrieval

Water vapor correction (band 2 and 1)



Evaluating AVHRR calibration using MODIS



Activities in the next 6 months

- Acquire and reformat the AVHRR L1B data for 1981-present.
- Apply in-flight calibration.
- Complete prototype code.
- Organize a Special Session at 2004 fall AGU on long-term satellite data record; appoint advisory committee (NOAA, CRC, CESBIO, MODIS land, Stanford, Udunee,JRC ISPRA).
- Appoint Graduate Research Assistant (done).